

**Principles of Economics**  
**Macroeconomics**  
**Long-Run Economic Growth**

J. Bradford DeLong  
U.C. Berkeley

# The Rule of 72

- A quantity growing at 1%/year doubles in 72 years...
- A quantity growing at 2%/year doubles in 36 years...
- A quantity growing at 3%/year doubles in 24 years...
- A quantity growing at 0.1%/year doubles in 720 years...
- A quantity growing at 0.01%/year doubles in 7200 years...

# Before Agriculture...

- Maybe 100K people in 48,000BC?
- Maybe 5M people in 8000BC?
- Rule of 72: almost 6 doublings in 40000 years—a doubling every thousand years, a growth rate of 0.01%/year...
- A healthy settled population with ample food and no effective artificial means of birth control doubles every generation: 2.5%/year growth rate...
- Buff...
- But short-lived...

# The Agrarian Age

- Maybe 5M people in 8000BC?
- Maybe 170M people in -1BC?
- Maybe 510M people in 1500?
- Rule of 72: 5 doublings in 8000 years—that's a doubling every 1600 years, a growth rate of 0.04%/yr
- Rule of 72: 1.6 doublings in 1500 years—a growth rate of 0.07%/yr
- Short: from 5'8" to 5'2"; lose your teeth; Petri dish for bacteria; life expectancy of 25; be really bored...
- Upper classes different...

# Malthus

- What happens in a society without artificial means of birth control if you acquire a significant margin above bare subsistence?
- What happens in a *poor* society *with* artificial means of birth control if you acquire a significant margin above bare subsistence?
  - Children as insurance...
- Preventative checks
  - Western European marriage pattern; Asian lineage household; female infanticide ; large celibate classes
- Positive checks:
  - Children so malnourished as to have compromised immune systems; women so malnourished as to stop ovulating; men so close to the edge to be willing to take violent gambles
- Competition between societies...

# Homer, *Iliad*, 18:398

- Thetis' silver feet took her to Hephaestus' house,  
A mansion the lame god had built himself...  
She found him at his bellows, glazed with sweat  
As he hurried to complete his latest project,:  
Twenty cauldrons on tripods to line his hall  
With golden wheels at the base of each tripod.  
...He was getting these ready,  
Forging the rivets with inspired artistry...

# Aristotle

- [I]f every instrument could accomplish its own work, obeying or anticipating the will of others, like the statues of Daedalus, or the catering serving carts of Hephaestus... the shuttle would weave and the plectrum touch the lyre without a hand to guide them, chief workmen would not want servants, nor masters slaves...
- But is there any one thus intended by nature to be a slave, and for whom such a condition is expedient and right?... There is no difficulty in answering this question... that some should rule and others be ruled is a thing not only necessary, but expedient; from the hour of their birth, some are marked out for subjection, others for rule...

# Guessing at Some Numbers

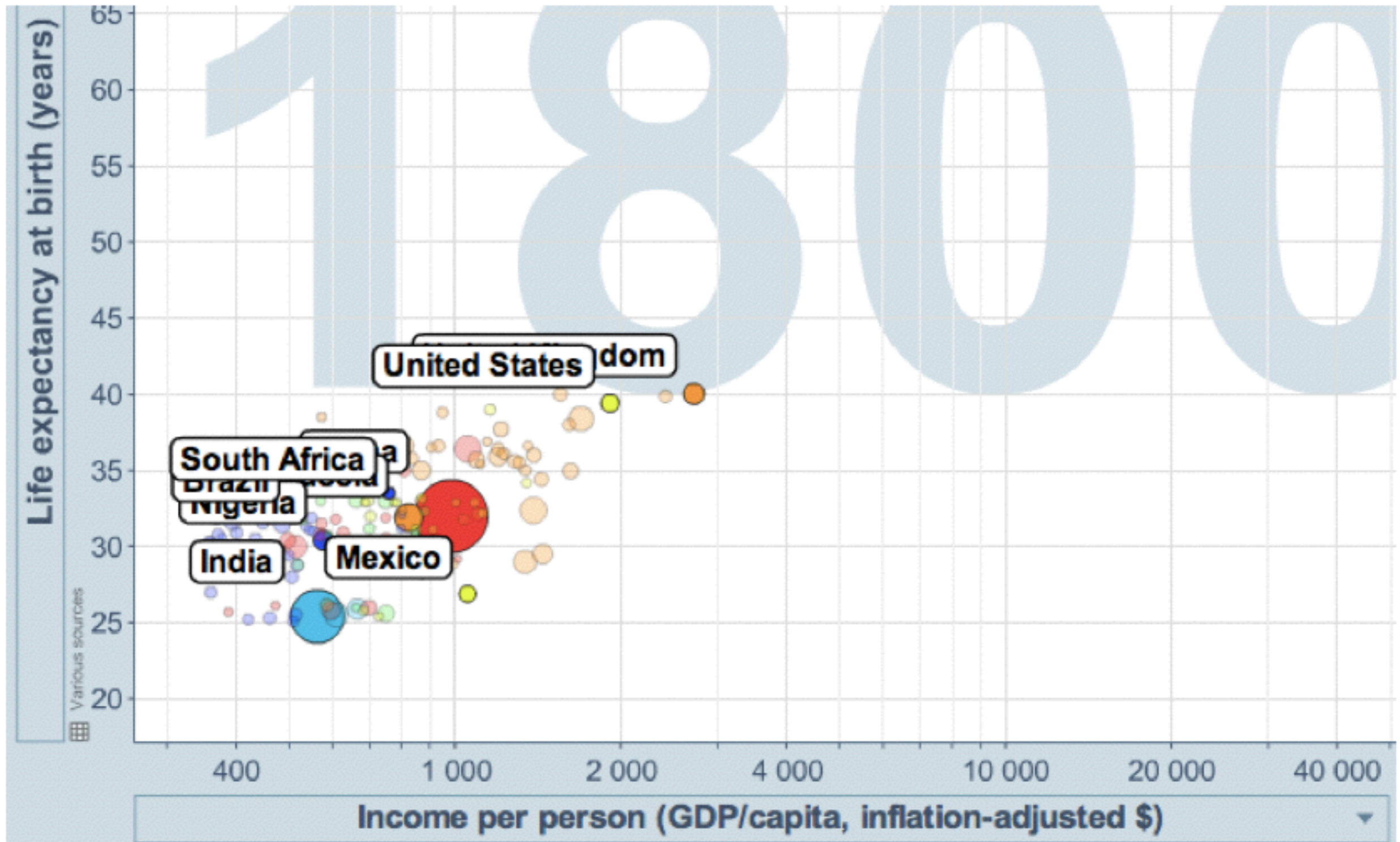
- 48000BC: Population: 100K. Living Standard: \$1000/yr?
- 8000BC: Population: 5M. Living Standard: \$1000/yr?
- -1BC: Population: 170M. Living Standard: \$500/yr
- 1500: Population: 510M. Living Standard: \$500/yr
- 1800: Population: 750M. Living Standard: \$600/yr
- 1900: Population: 1.5B. Living Standard: \$1200/yr
- 2014: Population: 7.4B. Living Standard: \$7600/yr



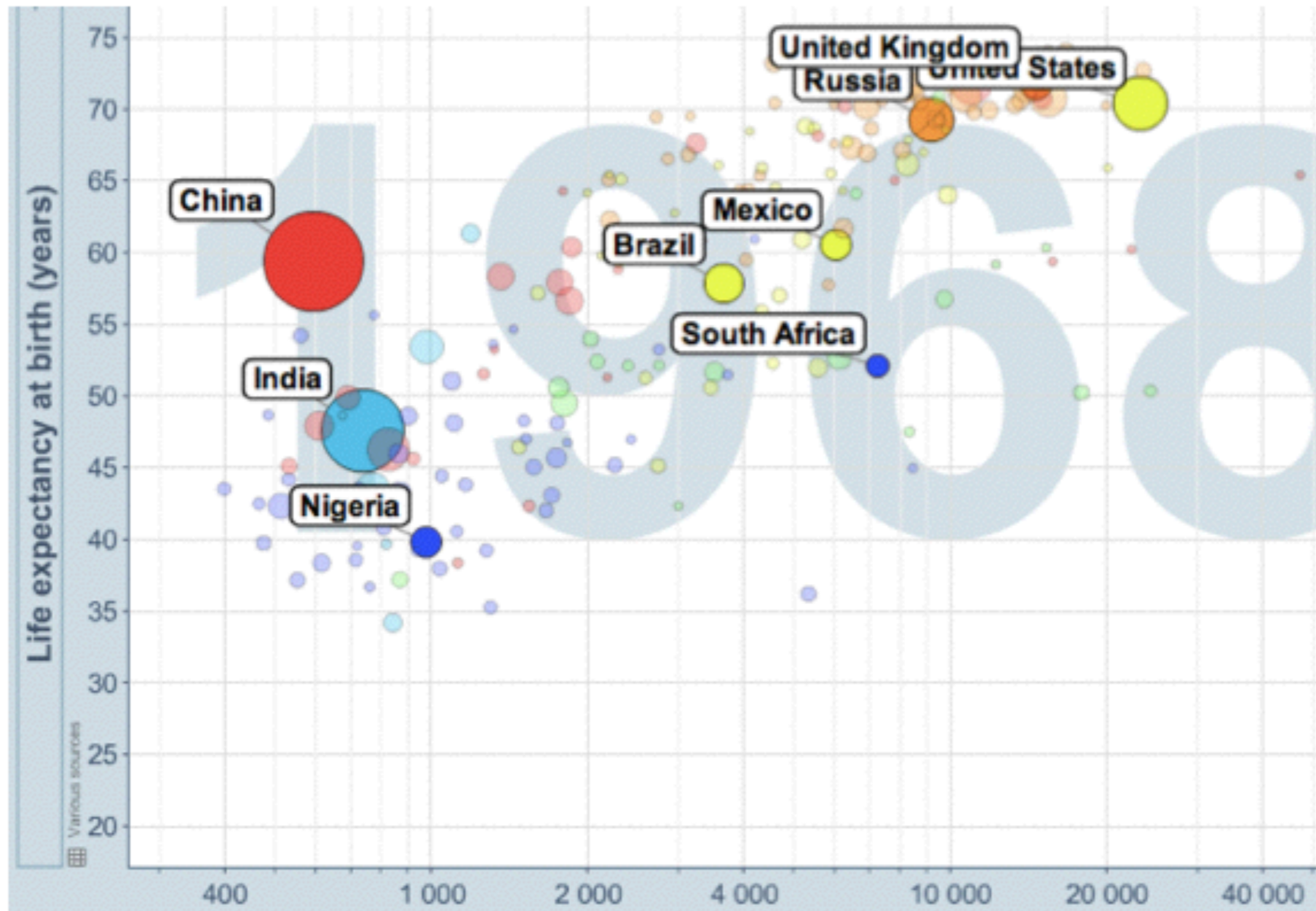
# What Happened?

- What happened post-1800? We call it the Industrial Revolution
- • What happened after 1500? Not the market economy—rather, limited government plus the Columbian exchange
- What did not happen before 1500? They were, after all, about as smart as we are...
- We are going to note that these big historical questions exist...

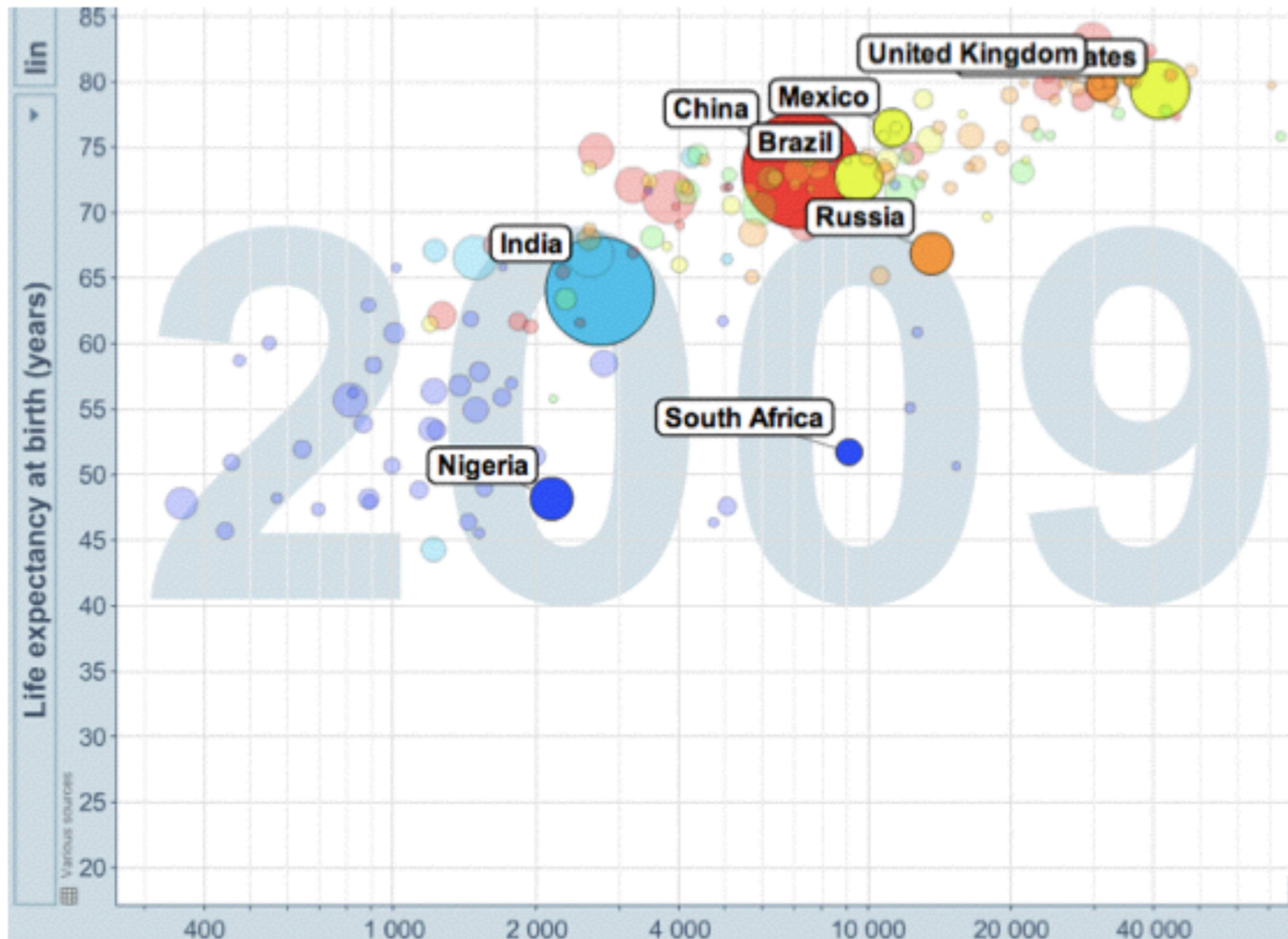
# The World in 1800



# The Great Divergence to 1968



# Convergence Post 1968?



# Why Divergence?

- The agrarian legacy
  - China's population has grown by a factor of 7 since 1800
  - Egypt's by a factor of 30
  - If most of your people are still unmechanized farmers, that is a huge set of headwinds
- The infrastructural task
  - Even if most of your people aren't unmechanized farmers and live in cities, a rapid population growth rate means a large investment burden
- Difficulties of technology transfer
- Difficulties of government
  - Communism
  - Corruption

# Why Convergence?

- End of High Communism
- Expansion of world trade
- Technology transfer
- But if you look at it, the big difference between before 1968 and after 1968 is the different destinies of two countries
  - China
  - India

# A Not-so-Long March

